CLAIMS

What is claimed is:

1. A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and at least one client control apparatus is performed, the control system comprising:

a means provided in the host control apparatus, for embedding emergency-stop data in a serial-data communication frame when a malfunction occurs inside the host control apparatus or when an emergency-stop signal is inputted to the host control apparatus, for embedding predetermined frame-error check data in the serial-data communication frame each time the serial-data communication frame is generated, and for outputting the frame to the client apparatus;

an extracting means provided in the client control apparatus, for extracting the emergency-stop data and the frame-error check data from the frame that is transmitted from the host control apparatus to the client control apparatus; and

a means provided in the client control apparatus, for determining whether or not the frame has been generated normally in the host control apparatus by checking the frame-error check data extracted by the extracting means, and for outputting to an apparatus to be controlled the emergency-stop data when the emergency-stop data is embedded in the serial-data communication frame and condition in which the frame is not generated normally in the host control apparatus is continued for a duration corresponding to a plurality of frames.

2. A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and at least one client control apparatus is performed, the control system comprising:

a means provided in the client control apparatus, for embedding emergency-stop data in a serial-data communication frame to be outputted by the client control apparatus when a malfunction occurs inside the client control apparatus, for embedding predetermined frame-error check data in the serial-data communication frame to be outputted by the client control apparatus each time the serial-data communication frame is generated, and for outputting the frame to the host control apparatus;

an extracting means provided in the host control apparatus, for extracting the emergency-stop data and the frame-error check data from the frame that is transmitted from the client control apparatus to the host control apparatus; and

a means provided in the host control apparatus, for determining whether or not the frame has been generated normally in the client control apparatus by checking the frame-error check data extracted by the extracting means, and for determining that the client control apparatus is out of order when the emergency-stop data is embedded in a serial-data communication frame and condition in which the frame is not generated normally in the client control apparatus is continued for a duration corresponding to a plurality of frames.

3. A control system utilizing serial-data communication, in which the

serial-data communication between a host control apparatus and a plurality of client control apparatuses, or among the plurality of client control apparatuses is performed, the control system comprising:

a means provided in the client control apparatus, for embedding emergency-stop data in a serial-data communication frame to be outputted by the one client control apparatus when a malfunction occurs inside the client control apparatus or when an emergency-stop signal is inputted to the one client control apparatus, for embedding predetermined frame-error check data in the serial-data communication frame to be outputted by the client control apparatus each time the serial-data communication frame is generated, and for outputting the frame to the host control apparatus and/or the other client control apparatus;

an extracting means provided in the client control apparatus, for extracting the emergency-stop data and the frame-error check data from the frame that is transmitted from the host control apparatus and /or the other client control apparatuses to the client control apparatus; and

a means provided in the client control apparatus, for determining whether or not the frame has been generated normally in the host control apparatus and/or the other client control apparatus by checking the frame-error check data extracted by the extracting means, and for outputting to an apparatus to be controlled the emergency-stop data when the emergency-stop data is embedded in the serial-data communication frame and condition in which the frame is not generated normally in the host control apparatus and/or the other client control apparatus is continued for a duration corresponding to a plurality of frames.

4. The control system utilizing serial-data communication, according to any one of claim 1 through 3,

wherein the means for embedding the frame-error check data in the frame generates the frame-error check data to which a specific numerical value is added each time the serial-data communication frame is generated, when the frame is generated normally, and embeds the frame-error check data in the frame; and

wherein the means for determining compares previously received frame-error check data with presently received frame-error check data, and determines that the frame is not generated normally when a difference value between the previously received frame-error check data and the presently received frame-error check data is different from the specific numerical value.

5. A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and a plurality of client control apparatuses, or among the plurality of client control apparatuses is performed, the control system comprising:

a means provided in the client control apparatus, for embedding emergency-stop data generated by the other client control apparatus in a frame to be outputted by the client control apparatus, and transmitting the frame to the host control apparatus and/or the other client control apparatus.

6. A control system utilizing serial-data communication, in which the serial-data communication between a host control apparatus and a plurality of client control apparatuses, or among the plurality of client control apparatuses is performed, the control system comprising:

a means provided in the client control apparatus, for embedding emergency-stop data generated in the control apparatus when a malfunction occurs inside the one control apparatus and emergency-stop data generated in the other control apparatus in a serial-data communication frame to be outputted by the client control apparatus, for, embedding predetermined frame-error check data in the serial-data communication frame to be outputted by the client control apparatus each time the serial-data communication frame is generated, and for outputting the frame to the client control apparatus and/or the other client control apparatus;

an extracting means provided in the client control apparatus, for extracting the emergency-stop data and the frame-error check data from the frame that is transmitted from the host control apparatus, or the other client control apparatus, to the client control apparatus; and

a means provided in the client control apparatus, for determining whether or not the frame has been generated normally in the host control apparatus or the other client control apparatus by checking the frame-error check data extracted by the extracting means, and for outputting to an apparatus to be controlled the emergency-stop data when emergency-stop data is embedded in the serial-data communication frame and condition in which the frame is not generated normally in the host control apparatus or the other client control apparatus is continued for a duration corresponding

to a plurality of frames.

7. The control system utilizing serial-data communication according to any one of claims 1 through 3 and 5 through 6, comprising:

a counting unit provided in the host control apparatus and/or the client control apparatus for counting the number of the received frames; and

a means provided in the host control apparatus and/or the client control apparatus, for outputting the emergency-stop signal in the case where a specific number of frames are not received.